

# KAIZEN IMPLEMENTATION IN OIL FIELD PROJECT DEVELOPMENT PROCESS IN PT. CPI

Ficky Kusuma Adijaya,  
School of Business and Management,  
Institute of Technology Bandung (ITB), Indonesia.  
Email: [fickykusuma@sbm-itb.ac.id](mailto:fickykusuma@sbm-itb.ac.id)

**Abstract.** Drilling new wells is an important activity to arrest production decline in every oil company, no difference in PT. Cahaya Putera Indonesia (CPI). The project development process cycle time is critical to make sure the team can deliver the quantity of new wells proposals. Activities in the project development process need to be revisited and evaluated to deliver most value and eliminate non-adding value activities.

During the value stream mapping approximately 50% of the activities are considered redundant thus is waste to the whole process. Much of the analysis can be done in a centralized manner and then used it to multiple projects instead of keep re-inventing the wheels in every project. Kaizen implementation have reduced phase 1-3 cycle time by 36%, 36% and 11 % respectively.

In this research, Kaizen implementation was only to reduce cycle time for first three phases. It was not intended to improve decision quality of each project. Future analysis could add six sigma efforts to CPDEP to increase quality decision of projects.

**Keywords:** Lean, Kaizen, Project Management, Oil Field

## 1. Introduction

PT. Cahaya Putera Indonesia (CPI) is an oil field operator in Indonesia. It produces 30% of Indonesia's national oil production. Sakai field is one of CPI's large oil field. Decline rate from this field will affect significantly to CPI's total decline rate as Sakai field production is almost 50% of total CPI production.

Just like in any oil company, production is naturally declining over time. If nothing is done then production will keep declining and eventually shut in. In order to arrest production decline, new production needed to compensate the decline. Figure 1 illustrates a typical oil field production trend and how individual drilling project helped to arrest total production decline. Sakai Field Asset Management Team is responsible to deliver Capital Project packages of new wells drilling in a quantity around 300 wells annually to maintain field's production decline to 15% per year.

CPI uses internal process called CPDEP (CPI Project Development and Execution Process) to generate project proposals. CPDEP consists of five phases: Opportunity Identification, Alternative Generation, Alternative Selection, Execution, and Lookback. The most time and resource consuming process is in the first three phases. Kaizen methodology is then implemented in CPDEP to improve internal business process in order to expedite project development process cycle time without reducing the decision quality of the project.

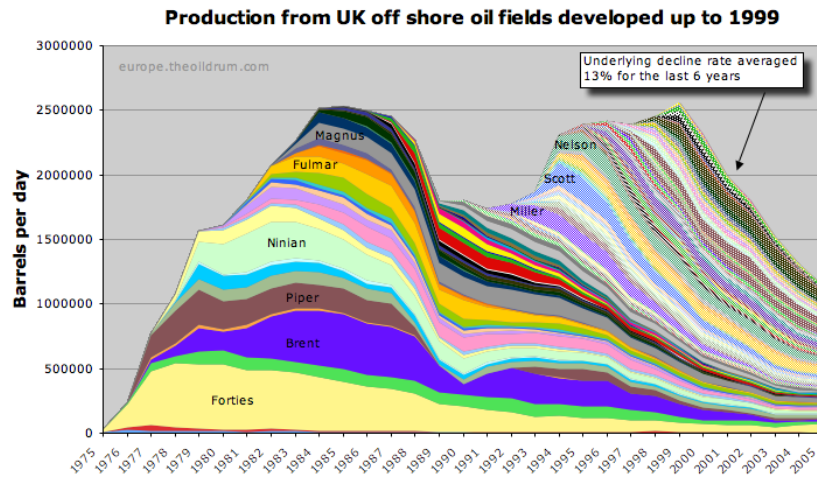


Fig. 1: Typical oil production profile

## 2. Theoretical Foundation

Balanced Scorecard is an example of a closed-loop controller or cybernetic control applied to the management of the implementation of a strategy. Closed-loop or cybernetic control is where actual performance is measured, the measured value is compared to an expected value and based on the difference between the two corrective interventions are made as required. Such control requires three things to be effective - a choice of data to measure, the setting of an expected value for the data, and the ability to make a corrective intervention.<sup>1</sup>

Balanced scorecards bring the 3R advantages to the organization, namely, doing right things, doing them right, and doing them at the right time.

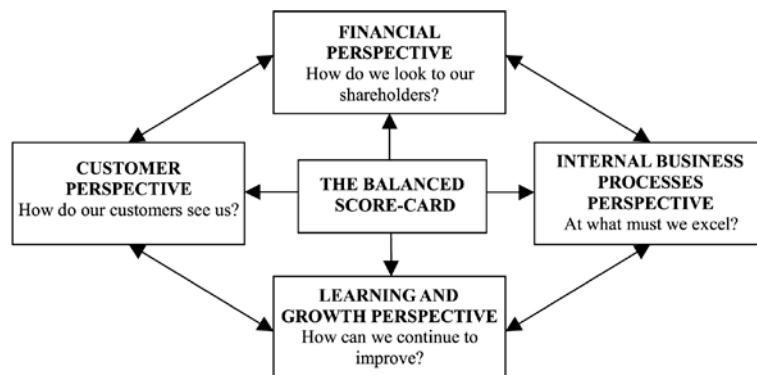


Fig. 2: The Four Perspectives of the Balanced Score-Card

Since 1986 management as a science has been undergoing sufficient changes. A legendary book, which has changed the vision of managers on how to run their business, was published that year. A book written by Masaaki Imai (Kaizen: the key to Japan's competitive success) became a foundation for further development of a new managerial concept based on continuous improvement and quality orientation.

The cycle of Kaizen activity can be defined as:

- Standardize an operation and activities,
- Measure the operation (find cycle time and amount of in-process inventory).
- Gauge measurements against requirements.
- Innovate to meet requirements and increase productivity.
- Standardize the new, improved operations.
- Continue cycle *ad infinitum*.

This is also known as the Shewhart cycle, Deming cycle, or PDCA.

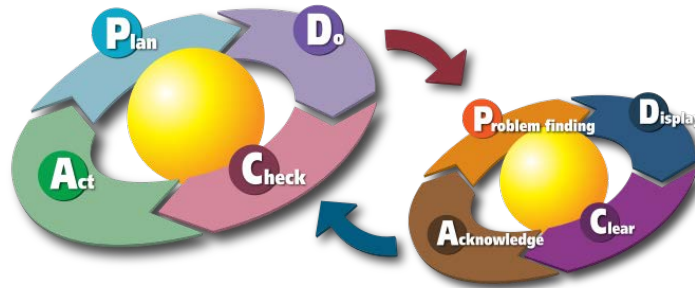


Fig. 3: The PDCA cycle

The major advantage of Kaizen is the approach to making changes and monitoring results on a continuous basis as its fundamental methodology. As such, the management is able to create small experiments in its business processes instead of large scale planning or project scheduling. Since the Kaizen events are small in nature, the results of the experiments are immediately available. This is used for further suggestions and ideas for corrections or improvements in all the existing business processes.

### 3. Methodology

Once we have identified a work process on which we want to apply the Kaizen method, there are basic steps we need to take:

1. Define the problem
2. Document the current situation
3. Visualize the ideal situation
4. Define measurement targets
5. Brainstorm solutions to the problem
6. Develop Kaizen plan
7. Implement plan
8. Measure, record and compare results to targets
9. Prepare summary documents
10. Create short term action plan, on-going standards and sustaining plan

The problem that CPI has is long cycle time in generating and developing a capital project. Even though CPI already has standard flow process called CPDEP, it doesn't guarantee a project can move fast within the workflow. A look back of previously executed projects reveals cycle time on each phase of the first three phases of the CPDEP shown in figure 4.

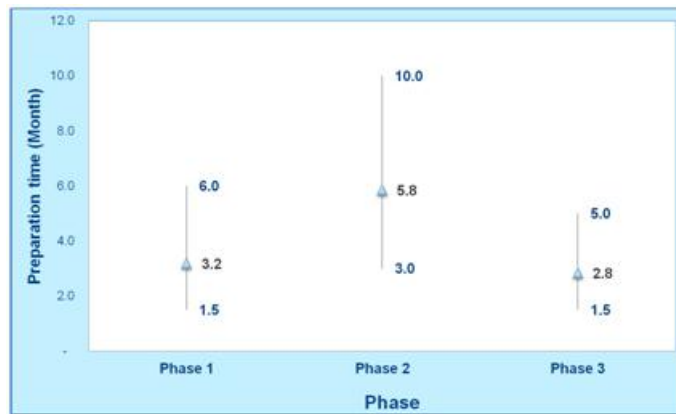


Fig. 4: Cycle Time and Variance on CPDEP First Three Phases

After measuring current process, next step is to build a Value Stream Map. Value stream mapping is a lean-management method for analyzing the current state and designing a future state for the series of events that take a product or service from its beginning through to the customer. At Toyota, it is known as "material and information flow mapping".<sup>2</sup>



Fig. 5: Value Stream Mapping

After developing a VSM, we can easily identify activities that are vital in the value creation flow and also to identify activities that are unnecessary (not creating value) but create delay in the workflow. To make a clear cause and effect relation, a fishbone diagram is generated.

Ishikawa diagrams (also called fishbone diagrams, herringbone diagrams, cause-and-effect diagrams, or Fishikawa) are causal diagrams created by Kaoru Ishikawa (1968) that show the causes of a specific event.<sup>3</sup> Common uses of the Ishikawa diagram are product design and quality defect prevention, to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify these sources of variation.

### Fishbone Diagram

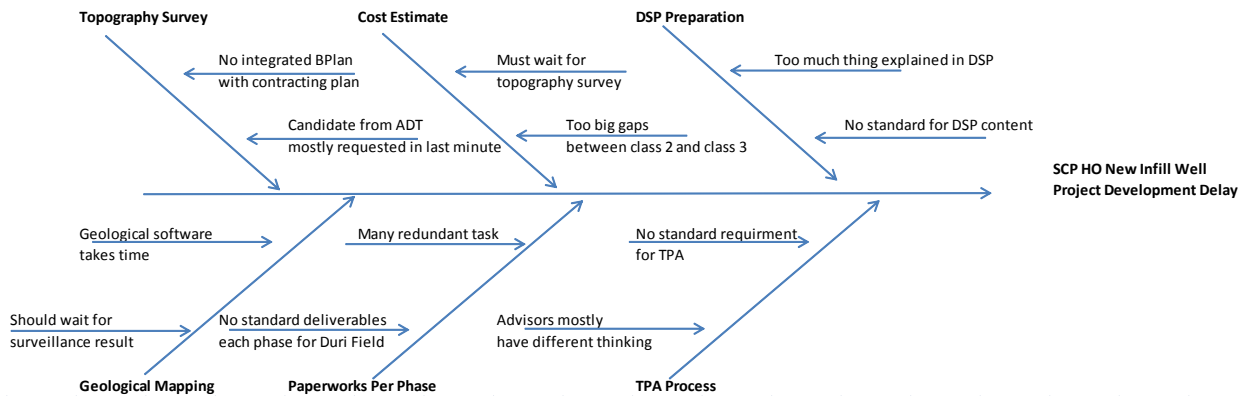


Fig. 6: Fishbone diagram to understand cause of delays

With ‘bottleneck’ activities identified, we continue with a brainstorming session on how to minimize or even eliminate such non-value creating activities. First we list all activities done in each phase of CPDEP. Then we evaluate these activities into three categories:

- **R: Required**

These are activities that are vital and cannot be eliminated. However, we can minimize time and resources to do these activities. One example of the way is by standardization.

- **O: Optional**

These are activities that are not vital but can be helpful and in some conditions are necessary. To avoid doing these activities on every project, even in the ones that is not required, we then developed a standard evaluation on what project should do these activities and what project that shouldn't.

- **M: Master Document**

These are activities that are vital, but it can be done in a one-time basis and then can be used in the next phases without redoing it again. These kinds of activities should be documented for then be used in next phases in the project. Some of these activities even can be used to other projects.

Figure 7, 8 and 9 shows how activities are evaluated and categorized. Some of optional activities are even eliminated shown by their names typed in light grey.

IBU SCP (Small Capital Project) Guideline				
CPDEP Phase-1				
Description	Deliverables based on Project Category			
	Master Document	Category 2-A	Category 2-B	Category 3
<b>Phase-1 Deliverables:</b>				
<b>Project Framing:</b>				
Decision Makers and Project Team Identification		R	R	R
Opportunity Statement (What & Why)	M	R	R	R
Strategic Fit with Business Unit Strategies		O	O	O
Business Case	M	R	R	R
Success Vision and Success Measure	M	R	R	R
Value Drivers and Value Measures		O	O	O
Frame and Boundary Conditions	M	R	R	R
Stakeholders Analysis	M	R	R	R
*) Risk Analysis and Mitigation Plan (Facility Project) or Uncertainty Management Plan (Subsurface Project) "(High Level)"		R	R	R
Decision Hierarchy (Facility Project) or Decision Sequence (Subsurface Project)	M	R	R	R
Preliminary Strategy Table (Facility Project) or Value Based Well Objectives (Subsurface Project)		O	O	O
Class-1 Cost Estimate (+50%/-30%)		R	R	R
Level-1 Schedule (Milestones; also consider Drilling Schedule)		R	R	R
*) Project Execution Plan for Phase-2 (including IFO - as applicable)		R	R	R
<b>VIPs &amp; Best Practices:</b>				
Incorporate Lessons Learned from Other Projects		R	R	R
DQ Self Assessment (by Project Team)		O	O	R
<b>Project Assurance (Internal IBU):</b>				
*) Technical Codes and Standards		N	N	N
*) Quality Management		N	N	N
*) Project Operations Planning (Facility Project)		N	O	O
*) Operational Readiness Review (Facility Project)		N	N	N
<b>Decision Analysis (Revenue Generating Project):</b>				
Deterministic Economic Analysis		R	R	R
Sensitivity Analysis (Using Tornado Chart)		N	O	O
<b>Phase Gating:</b>				
Phase-1 DSP (Decision Support Package)		R	R	R
DE/DRB Sign Off for Phase-1 to Phase-2 Gate		R	R	R
<b>Note:</b>				
*) = OE Process Requirements				

Fig. 7: Phase 1 Activities Categorization



IBU SCP (Small Capital Project) Guideline				
CPDEP Phase-2				
Description	Deliverables based on Project Category			Category
	Master Document	Category 2-A	Category 2-B	Category 3
<b>Phase-2 Deliverables:</b>				
<b>Project Framing:</b>				
Decision Makers and Project Team Identification		O	O	O
Fully Defined Scope of Selected Alternative		O	O	O
Stakeholders Analysis		O	O	O
Risk Analysis and Migration Plan (Facility Project) or Uncertainty Management Plan (Subsurface Project)		O	O	O
Business Case		O	O	O
Success Vision and Success Measure		O	O	O
Value Drivers and Value Measures		O	O	O
Frame and Boundary Conditions		O	O	O
Stakeholders Analysis		O	O	O
Risk Analysis and Migration Plan (Facility Project) or Uncertainty Management Plan (Subsurface Project)	M	R	R	R
Decision Hierarchy (Facility Project) or Decision Sequence (Subsurface Project)		O	O	O
Strategy Table (Facility Project) or Value Based Well Objectives (Subsurface Project)		R	R	R
Preliminary Basis of Design (Subsurface Project)		R	R	R
Project Execution Plan for Phase-3 (including FID, Commercial, Land, Contracting & Procurement and Constructability - as applicable)	M	O	O	O
Class-2 Cost Estimate (41-30%)		R	R	R
Level-2 Schedule (also consider drilling schedule)		R	R	R
VIPs & Best Practices:		O	O	O
DO Self Assessment (by Project Team)		R	R	R
Self Assessment (by Project Team) or Well Construction CPDEP Implementation (Subsurface Project)		O	O	O
DEIRB (Internal BU):		O	O	O
Phase-2 Peer Assist		O	O	O
Technical Codes and Standards		O	O	O
Decision Analysis (Revenue Generating Project):		O	O	O
Deterministic Economic Analysis		R	R	R
Sensitivity Analysis (Using Tornado Chart)		R	R	R
Probabilistic Economic Analysis		R	R	R
DA Model & Analysis Review		R	R	R
Phase Gating:		R	R	R
Phase-3 Decision Support Package (DSP)		R	R	R
DEIRB Sign off for Phase-2 to Phase-3 Gate		R	R	R
Note:				
• = OE Process Requirements				

Fig. 8: Phase 2 Activities Categorization

IBU SCP (Small Capital Project) Guideline				
CPDEP Phase-3				
Description	Deliverables based on Project Category			Category
	Master Document	Category 2-A	Category 2-B	Category 3
<b>Phase-3 Deliverables:</b>				
Decision Makers and Project Team Identification		O	O	O
Fully Defined Scope of Selected Alternative		O	O	O
Stakeholders Analysis		O	O	O
Risk Analysis and Migration Plan (Facility Project) or Uncertainty Management Plan (Subsurface Project)		O	O	O
Business Case		O	O	O
Success Vision and Success Measure		O	O	O
Value Drivers and Value Measures		O	O	O
Frame and Boundary Conditions		O	O	O
Stakeholders Analysis		O	O	O
Risk Analysis and Migration Plan (Facility Project) or Uncertainty Management Plan (Subsurface Project)	M	R	R	R
Decision Hierarchy (Facility Project) or Decision Sequence (Subsurface Project)		R	R	R
Strategy Table (Facility Project) or Value Based Well Objectives (Subsurface Project)		R	R	R
Preliminary Basis of Design (Subsurface Project)		O	O	O
Project Execution Plan for Phase-4 (including FID, Commercial, Land, Contracting & Procurement, Materials Management and Constructability - as applicable)		R	R	R
Class-3 Cost Estimate (41-10%)		R	R	R
Level-3 Schedule (also consider drilling schedule)		R	R	R
VIPs & Best Practices:		O	O	O
DO Self Assessment (by Project Team)		R	R	R
Self Assessment (by Project Team) or Well Construction CPDEP Implementation (Subsurface Project)		O	O	O
DEIRB (Internal BU):		O	O	O
Phase-3 Peer Assist		O	O	O
Technical Codes and Standards		O	O	O
Decision Analysis (Revenue Generating Project):		O	O	O
Deterministic Economic Analysis		R	R	R
Sensitivity Analysis (Using Tornado Chart)		R	R	R
Probabilistic Economic Analysis		R	R	R
DA Model & Analysis Review		R	R	R
Phase Gating:		R	R	R
Phase-3 Decision Support Package (DSP)		R	R	R
DEIRB Sign off for Phase-3 to Phase-4 Gate		R	R	R
Appropriation Request (GD-36/GCI/AFE)		R	R	R
Note:				
• = OE Process Requirements				

Fig. 9: Phase 3 Activities Categorization

After evaluating, categorizing and modifying activities in each phase. We then generate a new timeline that is needed to go through the new workflow to see the difference with the previous workflow.

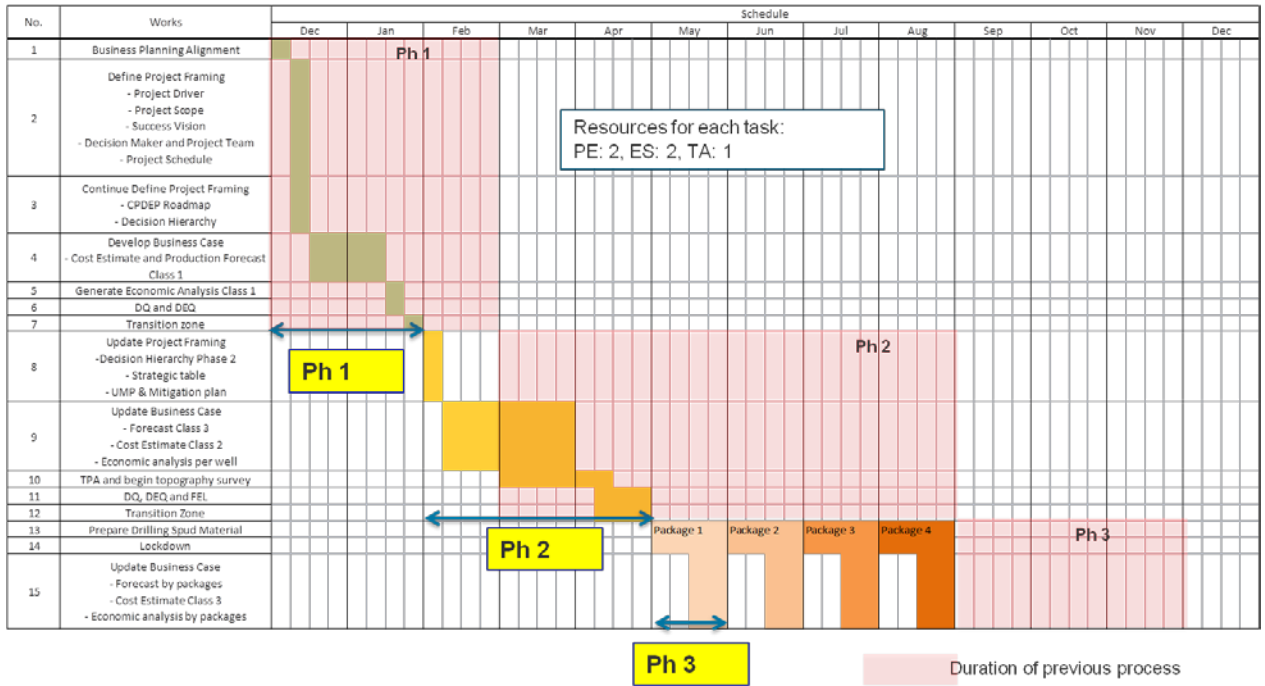


Fig. 10: Timeline Comparison between Old and New Workflow

Theoretically, the new workflow can save time in first three phases as much as 33%, 50% and 66% respectively. To make sure that the new workflow is consistently implemented, team then communicates this to management to get endorsement.



## 4. Research Finding

With buy-in and endorsement from management, the implementation of recommendation as result of Kaizen can be consistent. Kaizen team then monitors the implementation and record the result of the implementation.

Even though theoretically the new workflow can save time in first three phases as much as 33%, 50% and 66% respectively, however, in the practice the numbers are different. Phase-1 average improved up to 36%. In some cases, phase 1 activities are only done once and then used for several projects which mean it's a 100% time saving. Phase-2 average improved 36%, while phase-3 average also improved 11%.

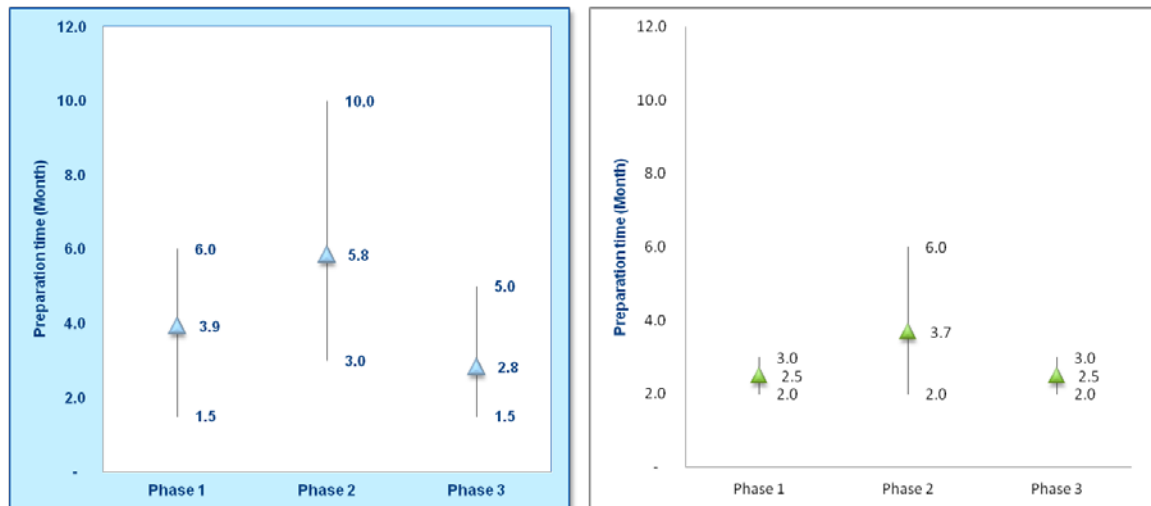


Fig. 11: Comparison of Cycle Time in Each Phases before (left) and after (right) implementation of Kaizen

## 5. Discussion and Recommendation

In the implementation, Kaizen process gives most time saving in CPDEP Phase-1. It is understandable since most activities in Phase-1 are generic and not detail. In CPDEP Phase-2 Kaizen improved cycle time by eliminating redundant work already done in Phase-1 such as project framing. In CPDEP Phase-3 Kaizen only improve an average of 11%. This is due to the nature of Phase-3 activities which already involves actual physical activities and requires resources outside of the organization, such as topographic survey. Kaizen has been effectively improved CPI's internal business process by shortening project development cycle time which in turn improve CPI's financial performance from increased oil production coming from new wells.

Balanced scorecards focus on four major business perspectives of business process, learning and growth, financial, and customer. The balanced scorecard metrics of business process assist the management in proper analyzing of the business and decide on the conformation of the products to the needs of the customers. The learning and growth perspective focuses on the training of the employees in utilization of balanced scorecards and Kaizen principles to improve the workplace performance.

It is obvious that the traditional performance metrics are not effective in the global competitive environment. Hence, new and dynamic strategic planning is required to address the issues arising from constantly changing business environments of the present times. As such, the management and the employees should fully comprehend the necessity of rethinking in the business strategies to suit the prevailing conditions.

Kaizen is an excellent way to formalize some simple improvement activities that are not always run in an optimal format. Kaizen also avoids the stigma of a formalized project that may be drawn out over

several weeks or months. Most importantly, Kaizen provides just-in-time process improvements. By using the above 10-step methodology, ensuring the relevant parties are participating and empowered, and that those steps not able to be completed in the event are completed within 30 days, Kaizen can enable significant and sustainable improvements to any organization.<sup>4</sup>

## 6. References

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